



CIGNA MEDICAL COVERAGE POLICY

The following Coverage Policy applies to all plans administered by CIGNA Companies including plans administered by Great-West Healthcare, which is now a part of CIGNA.

**Subject Magnetic Resonance
Angiography (MRA)**

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Coverage Policy

CIGNA covers magnetic resonance angiography (MRA) as medically necessary as an adjunct to other testing when ANY of the following indications are met:

- diagnostic head and neck vascular imaging for suspected pathology (e.g., suspected or known stroke, subarachnoid hemorrhage, cerebral aneurysm, atherosclerotic disease, arteriovenous malformation)
- screening or surveillance of intracranial aneurysm for any of the following:
 - an individual with a rare heritable disorder known to be associated with vascular anomalies (e.g., autosomal dominant polycystic kidney disease, Ehlers-Danlos syndrome)
 - every ten years for an individual ≥ 30 years old with at least two first-degree relatives with a history of intracranial aneurysm AND the individual is considered high risk for aneurysm (i.e., female; personal history of hypertension; personal history of smoking)
 - known unruptured intracranial aneurysm
 - annually for an individual previously treated with endovascular coiling
 - every ten years, for an asymptomatic individual previously treated for an intracranial aneurysm with neurosurgical clipping
- diagnostic thoracic vascular imaging for suspected pathology (e.g., suspected or known aortic dissection or aneurysm, AVM, pulmonary artery hypertension, thoracic outlet syndrome)
- evaluation of suspected coronary artery disease (CAD) in a symptomatic individual to evaluate suspected coronary anomalies

- evaluation of left ventricular (LV) function when there are technically limited images on echocardiogram or nuclear study for any of the following:
 - acute myocardial infarction
 - heart failure
 - cardiotoxic therapies
 - myocarditis
 - conditions where other imaging studies yielded inconclusive or conflicting results
- evaluation of a individual with positive cardiac enzymes and a negative angiogram (i.e., normal coronary arteries, no obstructive atherosclerosis) in whom a strong suspicion of a cardiac condition (e.g., myocarditis, myocardial infarction, coronary artery spasm, coronary embolism) remains
- diagnostic evaluation when questionable or indeterminate findings on echocardiogram are present for ANY of the following:
 - complex congenital heart disease (e.g., anomalies of coronary circulation, great vessels, and cardiac chambers and valves)
 - cardiomyopathies (e.g., infiltrative [amyloid, sarcoid], hypertrophic cardiomyopathy (HCM), or due to cardiotoxic therapies)
 - characterization of native and prosthetic cardiac valves—including planimetry of stenotic disease and quantification of regurgitant disease and technically limited images from echocardiogram or transesophageal echocardiogram (TEE)
- evaluation of the pulmonary veins and left atrium prior to radiofrequency ablation for atrial fibrillation or supraventricular tachycardia
- diagnostic abdominal vascular imaging for suspected pathology (e.g., suspected or known abdominal aortic aneurysm or dissection, renovascular hypertension)
- evaluation of suspected or known peripheral arterial disease
- evaluation of suspected or known vascular abnormalities associated with congenital conditions (e.g., pulmonary sequestration, complete and incomplete vascular rings)
- diagnostic evaluation when medically necessary conventional x-ray angiography is precluded because there is a specific contraindication to iodinated contrast material (i.e., allergy to iodinated contrast material, renal insufficiency, or medical condition that precludes exposure to additional large doses of ionizing radiation [e.g., genetic predisposition or mutation repair disorder])

CIGNA does not cover MRA for any other indication, including, but not limited to, the following because it is considered experimental, investigational or unproven for these indications (this list may not be all-inclusive):

- screening for coronary artery disease (CAD) in an asymptomatic individual
- post-revascularization (percutaneous coronary intervention or coronary artery bypass grafting surgery), including evaluation of bypass grafts, coronary anatomy or evaluation for in-stent restenosis
- imaging of suspected or known pulmonary embolism

General Background

Magnetic resonance (MR) angiography (MRA) is a magnetic resonance imaging (MRI) study of the blood vessels. It utilizes MRI technology to detect, diagnose and aid in the treatment of disorders and diseases involving the blood vessels. MRA provides detailed images of blood vessels without using any contrast material, although a special form of contrast material is often given to make the MRI images even more clear. The procedure is painless, and the magnetic field is not known to cause tissue damage of any kind. By analyzing the amount of energy released from tissues exposed to a strong magnetic field, MRA provides images of normal and diseased blood vessels as well as visualization and quantification of blood flow through these vessels. MRA is a general term used to describe MRI of vascular structures. Sometimes, the term magnetic resonance venography (MRV) may specifically be used to refer to a vein instead of an artery. MRA refers to a diverse group of MR pulse sequences. Three different mechanisms can be used to generate signal from flowing blood. The most common method, called time of flight (TOF), relies on inflow enhancement to generate images of blood flow. Flow images and quantitative measurements of flow velocity can be obtained using phase-contrast (PC) MRA methods in which the image contrast is generated by velocity-induced phase shifts. A third method

relies on enhancement of the blood signal by paramagnetic contrast agents and employs rapid, three-dimensional (3-D) T1-weighted gradient echo acquisitions (American College of Radiology [ACR], 2005).

Contrast-enhanced (CE) MRA (CEMRA) involves blood flow imaging after the individual receives an intravenous injection of a contrast agent. Gadolinium, a nonionic element, affects the way in which tissues respond to magnetization, resulting in better visualization of structures when compared to unenhanced studies. Some researchers propose that blood-pool agents can be used instead of the current extracellular contrast agents for first-pass arterial imaging. Digital subtraction angiography (DSA) is a computer-augmented form of conventional contrast angiography that obtains digital blood flow images as the contrast agent courses through a blood vessel. The computer "subtracts" bone and other tissue from the image, thereby improving visualization of blood vessels. DSA has a procedural risk of stroke between 0.7% and 1%. CEMRA with extra cellular contrast agents has become the standard of practice. The highly accurate but static anatomical road map thus generated can be supplemented with time-resolved MRA and blood flow measurement techniques for a more comprehensive assessment of systemic vascular disease. Three-dimensional (3-D) data can be reformatted into any obliquity to unfold tortuous arteries and veins.

Some common indications for MRA include:

- identify disease and aneurysms in the aorta or in other major blood vessels
- detect atherosclerosis disease in the carotid artery of the neck
- identify a small aneurysm or arteriovenous malformation inside the brain
- detect atherosclerotic disease that has narrowed the arteries to the legs and help prepare for surgery
- indicate disease in the renal artery or visualize blood flow to help prepare for a kidney transplant
- guide surgeons making repairs to diseased blood vessels, such as implanting or evaluating a stent
- detect injury to one of more arteries in trauma patients
- evaluate the details of arteries feeding a tumor prior to surgery
- identify dissection in the aorta or its major branches
- show the extent and severity of atherosclerosis in the coronary arteries
- plan for a surgical operation, such as coronary bypass
- screen individuals for arterial disease, especially patients with a family history of arterial disease or disorders (Radiological Society of North America, 2007)

MRA has important attributes that make it valuable in the assessment of vascular disease. Compared to radiographic catheter-based angiography, it is noninvasive with no risk of neurologic deficit, circulatory compromise due to vascular injury, or adverse effects of iodinated contrast material. Compared to vascular ultrasound (US), it has higher accuracy, is less operator-dependent, has greater freedom from interference by body habitus, and greater 3-D capability. It is a safer alternative to the patient than computed tomography angiography (CTA), as neither ionizing radiation nor iodinated contrast agents are used.

U.S. Food and Drug Administration (FDA)

The FDA regulates MRI systems as Class II devices, and the commonly used systems have been approved via the FDA 510(k) process.

Literature Review

Head and Neck

MRA is a useful modality when head and neck vascular visualization is needed. MRA is performed for suspected or known stroke, intracranial vascular occlusion, subarachnoid hemorrhage (SAH), cerebral aneurysms, arteriovenous malformations (AVM), carotid artery stenosis or occlusion, and carotid artery dissection. MRA may play a role when vascular visualization is needed in medically refractory or diagnostically difficult cases. MRA can also be used to examine the cerebral venous system (MR venography) (Ozsarlak, et al., 2004). The peer-reviewed scientific literature supports the use of MRA/MRV for head and neck vascular imaging (Debrey, et al., 2008; Broderick, et al., 2005; Wardlaw, et al., 2006; Lee, et al., 2005; U-King-Im, et al., 2004; Cosottini, et al., 2003; Nederkoorn, et al., 2003; Remonda, et al., 2002; White, et al., 2001; Jager, et al., 2000; Scarabino, et al., 1999).

Screening for Cerebral Aneurysms: Screening for and surveillance of cerebral aneurysms continues to be an area of debate. CTA may be used to screen patients with rare conditions such as autosomal dominant

polycystic kidney disease and Ehlers-Danlos syndrome (Bederson, et al., 2000; Vega, et al., 2002; Suarez, et al., 2006; Brown, et al., 2008).

The Magnetic Resonance Angiography in Relatives of Patients with Subarachnoid Hemorrhage Study Group states in "Risks and benefits of screening for intracranial aneurysms in first-degree relatives of patients with sporadic subarachnoid hemorrhage" (NEJM, 1999) that implementation of a screening program for the first-degree relatives of patients with sporadic subarachnoid hemorrhage "does not seem warranted at this time, since the resulting slight increase in life expectancy does not offset the risk of postoperative sequelae." In this prospective observational trial, 626 first-degree relatives of patients with subarachnoid hemorrhage were screened. Researchers found 33 unruptured aneurysms in 25 of them. Surgery in 18 increased life expectancy, at the expense of a decrease in function in 11, which was disabling in one. The American Heart Association (AHA) Recommendations for the Management of Patients With Unruptured Intracranial Aneurysms (Bederson, et al., 2000) notes that screening is not efficacious in family members with a single first-degree relative with aneurysmal SAH or an intracranial aneurysm. Bederson et al. also notes that until the efficacy of screening groups with the familial intracranial aneurysm (FIA) syndrome (≥ 2 first-degree relatives) has been evaluated in a population-based clinical study, "screening should be considered on an individual basis. Because the annual rate of new aneurysm formation in patients treated for aneurysmal SAH is reported to be as high as 1% to 2%, late radiological evaluation of this population should be considered."

Crawley et al. (1999) conducted an analysis to determine the utility of screening for cerebral aneurysm using three theoretical models. Each individual had ≥ 2 first-degree relatives (parent, sibling, or offspring) with intracranial aneurysm. Authors initially performed calculations using a prevalence of 9.8%; then repeated the calculations using estimates of the upper and lower 95% CI for prevalence of asymptomatic aneurysm in these families (i.e., 8.9% and 10.6%). The authors stated that screening for familial unruptured intracranial aneurysm using the best-available estimates for prevalence of aneurysm (9.8%) and rate of rupture (0.8% per annum) does not result in a net reduction in severe morbidity or death. Over a 30-year period, the strategy of 'MRA followed by DSA if MRA positive', results in severe morbidity or death in 26 individuals per 1000 patients screened. This is in comparison with the estimated natural history in the unscreened population of severe morbidity or death in 15 individuals. The authors noted that screening at 10-year intervals on three occasions causes almost two poor outcomes at the time of investigation, and treatment for one poor outcome is prevented. These calculations do not support a policy of screening individuals with a high risk of harboring an aneurysm because of a strong family history. The benefits will be even less in individuals without such a strong family history (for example, those with a single first-degree relative with symptomatic aneurysm).

In a prospective trial, the first-degree relatives of those affected with intracranial aneurysm were offered screening with MRA if they were previously unaffected, ≥ 30 years of age, and had a history of smoking and/ or hypertension (Brown, et al., 2008). Several potential risk factors were considered for possible inclusion in the model, as follows: patient age, sex, history and duration of hypertension, smoking history and pack-years of cigarette smoking, marijuana use, history and amount of alcohol use, history and amount of caffeine consumption, estrogen replacement therapy, body mass index, history of diabetes or of increased cholesterol, marital status, and educational level completed. Regression diagnostics was used to assess the final model for collinearity. MRA screening was performed in 303 first-degree relatives and of these 58 (19.1%) had at least one aneurysm. Overall, 71 aneurysms were detected, with multiple lesions being detected in 10 (17.2%) of 58 patients. Women had an aneurysm on MRA in 44 (24%) of 183 screening studies, compared with 14 (11.7%) of 120 studies obtained in men. Those in whom an aneurysm was detected had a mean age of 53.7 years. A history of current or prior cigarette smoking was present in 90% of those with aneurysms compared with 72% without lesions. The mean number of pack-years of cigarette smoking was 27.4 in those with an aneurysm, compared with 17.8 in those without an aneurysm. The duration of hypertension was 6.5 years in those with an aneurysm, compared with 4.4 years in those without an aneurysm. In a multivariate model, both duration of hypertension and pack-years of cigarette smoking increased the risk of aneurysm detection. For each 20 pack-years of cigarette smoking compared to never having smoked, there was a >3 -fold increased risk of harboring an aneurysm (odds-ratio [OR] 3.24), and duration of hypertension also increased the risk, with an OR of 1.26 when comparing those with 10 years of hypertension to those with no hypertension. Sex was also important, with women being more than twice as likely to harbor an aneurysm (OR 2.46). Authors concluded that these first-degree relatives are at particularly high risk and should be strongly considered for aneurysm screening.

Surveillance of Cerebral Aneurysms: The AHA Recommendations for the Management of Patients With Unruptured Intracranial Aneurysms (Bederson, et al., 2000) notes that CTA may be useful when patients with

identified unruptured intracranial aneurysms are given conservative followup, in patients with partially clipped aneurysms, or in those who have undergone treatment with endovascular techniques. The AHA Recommendations for the Endovascular Treatment of Intracranial Aneurysms (Johnston, et al., 2002) states that follow-up imaging after coil embolization provides an opportunity to identify inadequately treated aneurysms before subarachnoid hemorrhage or other symptoms occur. A variable number of aneurysms will require additional treatment after initial coil embolization. Johnston et al. notes that no data are available to define the appropriate timing of follow-up imaging. After apparent complete occlusion, many practitioners prescribe a follow-up angiogram at six months, with additional follow-up imaging based on aneurysm appearance. If complete occlusion is not possible, follow-up imaging is often obtained more frequently. Johnston et al. states that given the small risk of permanent complications with catheter angiography—recently estimated as <0.1% in this setting,—a noninvasive screening test to identify patients with recanalization after coil embolization is highly desirable but is complicated by the characteristics of the platinum coils. Although MR angiography can identify a residual aneurysmal neck, platinum coils are associated with artifacts that preclude reliable imaging of treated aneurysms with MR and CT angiography. Wermer et al. (2005a) performed a long-term follow-up study (mean follow up 8.0 years), of 752 patients who regained independence after SAH and in whom all detected aneurysms had been occluded by means of clipping. The authors concluded that the risk of a recurrence the first 10 years after treatment is 22 (12 to 38) times higher than the risk of SAH in a healthy cohort with comparable age and sex.

Thoracic and Abdominal (including Renal)

MRA is an effective diagnostic and presurgical planning tool for vascular conditions of the thorax, abdomen and pelvis (Hodgson, et al., 2006; Vasbinder, et al., 2004; Hacklander, et al., 2004; Kluge, et al., 2004; Wikstrom, et al., 2003; Tan, et al., 2002; Nasim, et al., 1998).

The appearance of nephrogenic systemic fibrosis (i.e., nephrogenic fibrosing dermopathy) has been reported to be associated with the use of gadolinium-based contrast agents. Although the risk associated with gadolinium may differ by contrast agent and dialysis modality, use of gadolinium-based contrast agents should be avoided when possible in patients with renal failure (Kallen, et al., 2008; Broome, et al., 2007; Marckmann, et al., 2006).

Pulmonary Embolism

Studies support diagnostic tools other than MRA for evaluating possible pulmonary embolism, such as D-dimer and CTA. Pulmonary MRA may be considered as an alternative to CTA when iodine contrast injection or radiation is a patient-specific significant matter (Stein, et al., 2006; Pleszewski, et al., 2006).

Lower Extremities

MRA/MRV of the lower extremities is an established diagnostic and surgical planning imaging procedure in the treatment of peripheral vascular disease. It is useful to diagnose anatomic location and degree of stenosis and in selecting patients with lower extremity disease as candidates for endovascular intervention. MRA of the extremities is usually performed with gadolinium enhancement (Schaefer, et al., 2007; de Vries, et al., 2006; Hirsch, et al., 2006; Ouwendijk, et al., 2005; Rapp, et al., 2005; Meissner, et al., 2004; Koelemay, et al., 2001; Visser, et al., 2000).

Congenital Vascular Abnormalities

The ACC (Hendel, et al., 2006) states that MRA is appropriate for evaluation of complex congenital heart disease, including anomalies of coronary circulation, great vessels, and cardiac chambers and valves. MRA is appropriate for imaging vascular abnormalities associated with congenital conditions (Goldstein, et al., 2007; Juraszek, et al., 2006; Dhawan, et al., 2004; Moll Bernardes, et al., 2006; Prasad, et al., 2004).

Cardiac

The ACC (Hendel, et al., 2006) states that MRA is inappropriate for the detection of CAD in the symptomatic patient, with the exception of when coronary anomalies are suspected.

Danias et al. (2004) conducted a literature review and meta-analysis. True and false-positive and true and false-negative coronary CEMRA assessments were recorded for detection of CAD using x-ray angiography as the reference standard. There were 39 studies; 41 separate comparisons were analyzed. Across 25 studies with data on 4620 segments (993 subjects), sensitivity and specificity for detection of CAD were 73% and 86%, respectively. Reviewers stated that coronary MRA may have value for exclusion of significant multivessel CAD

in subjects referred for diagnostic catheterization, but the available data do not suffice to introduce CEMRA as a widely-applied screening tool, particularly for individuals with low likelihood of CAD.

A comprehensive review of the literature relating to electron beam angiography (EBA), MRA, and spiral computed tomography (CT) was conducted (Budoff, et al., 2003). MRA demonstrated sensitivity for detection of obstructive CAD of 77% and specificity of 71%; EBA showed 87% and 91%; and CT showed 59% and 89%. The reviewers stated that noninvasive coronary angiography is a rapidly developing technique and currently not an alternative to conventional coronary angiography in all cases. They noted that all three methods are currently used clinically in certain centers with appropriate expertise. Budoff and colleagues concluded that elective use should provide a safer, less-invasive method for patients to determine the need for medical versus revascularization therapy.

A prospective multicenter study compared coronary MRA and x-ray coronary angiography performed in 109 patients with suspected coronary disease (Kim, et al., 2001). Overall, MRA had an accuracy of 72% in diagnosing coronary artery disease. The sensitivity, specificity, and accuracy for patients with disease of the left main coronary artery or three-vessel disease were 100%, 85%, and 87%, respectively. The authors concluded that 3-D coronary MRA accurately detects coronary artery disease of the proximal and middle segments in patients referred for their first x-ray coronary angiogram. They stated that it reliably identifies (or rules out) left main coronary artery or three-vessel disease.

Technology Assessments

The Health Technology Assessment (HTA) Program, part of the United Kingdom (UK) National Institute for Health Research (NIHR), published a Health Technology Assessment (Collins, et al., 2007). Collins et al. conducted a systematic review of duplex ultrasound, MRA and CTA for the diagnosis and assessment of symptomatic, lower limb PAD. Collins et al. concluded that contrast enhanced (CE) MRA has the best overall diagnostic accuracy of the three index tests evaluated. Where available, CE MRA may be a viable alternative to contrast angiography.

The Medicare Coverage Advisory Commission published a technology assessment on noninvasive imaging for CAD (Patel, et al., 2007). A review of the available scientific evidence through 2005 was conducted for direct noninvasive imaging tests for CAD. Specifically, a search for 16 (and higher) CTA and 1.5 Tesla MRA to evaluate for stenosis in native coronary arteries resulted in 123 articles. The authors concluded that “the evidence base for noninvasive direct coronary imaging technologies is currently inadequate for routine use in the diagnosis and management of CAD. Although the sensitivity and specificity of noninvasive direct coronary imaging technologies on a per patient basis look promising, specifically with 64-slice CTA, current studies are limited by number of studies available to determine if the data are generalizable to the U.S. Medicare population. Evaluation of noninvasive technologies in appropriate clinical situations, in patients with well-defined risk, at multiple centers is required. In addition, studies evaluating these technologies and their resultant effects on both clinical management and patient outcomes are lacking and needed. The ability to noninvasively image the coronary arteries provides the potential to leap into an age of improved early diagnosis and therapy for CAD. The burden of proof lies on the cardiovascular community to ensure that patients, payers, and clinicians realize this potential.”

Goodacre et al. (2006) conducted a health technology assessment (HTA) for the United Kingdom (UK) National Health Service (NHS). A total of 14 articles were included in the meta-analysis. Most studies compared MR venography with contrast venography in patients with suspected DVT. MR venography pooled estimate of sensitivity was 92%, and the pooled estimate of specificity was 95%.

Professional Societies/Organizations

American College of Cardiology Foundation (ACCF)/American College of Radiology (ACR)

The ACCF, ACR, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, American Society of Nuclear Cardiology, North American Society for Cardiac Imaging, Society for Cardiovascular Angiography and Interventions, and Society of Interventional Radiology published Appropriateness Criteria for Cardiac Computed Tomography and Cardiac Magnetic Resonance Imaging in October 2006 (Hendel, et al., 2006). MRA indications were rated appropriate, uncertain or inappropriate:

For the detection of CAD, symptomatic, evaluation of chest pain syndrome, MRA is:

- Inappropriate for intermediate pre-test probability of CAD and ECG interpretable and able to exercise
- Inappropriate for intermediate pre-test probability of CAD and ECG uninterpretable or unable to exercise
- Inappropriate for high pre-test probability of CAD

For detection of CAD, symptomatic, evaluation of intra-cardiac structures, MRA is:

- Appropriate for evaluation of suspected coronary anomalies

For detection of CAD, post-revascularization (percutaneous coronary intervention [PCI] or coronary artery bypass graft [CABG]), evaluation of chest pain syndrome, MRA is:

- Inappropriate for evaluation of bypass grafts
- Inappropriate if history of percutaneous revascularization with stents

For structure and function, evaluation of ventricular and valvular function, LV/RV mass and volumes, MRA, quantification of valvular disease, and delayed contrast enhancement, MRI/MRA is:

- Appropriate for assessment of complex congenital heart disease including anomalies of coronary circulation, great vessels, and cardiac chambers and valves AND procedures may include LV/RV mass and volumes, MR angiography, quantification of valvular disease, and contrast enhancement
- Uncertain for evaluation of LV function following myocardial infarction OR in heart failure patients
- Appropriate for evaluation of LV function following myocardial infarction OR in heart failure patients and patients with technically limited images from echocardiogram
- Appropriate for quantification of LV function and discordant information that is clinically significant from prior tests
- Appropriate for evaluation of specific cardiomyopathies (infiltrative [amyloid, sarcoid], HCM, or due to cardiotoxic therapies) and use of delayed enhancement
- Appropriate for characterization of native and prosthetic cardiac valves—including planimetry of stenotic disease and quantification of regurgitant disease and patients with technically limited images from echocardiogram or TEE
- Appropriate for evaluation for arrhythmogenic right ventricular cardiomyopathy (ARVC) and patients presenting with syncope or ventricular arrhythmia
- Appropriate for evaluation of myocarditis or myocardial infarction with normal coronary arteries and positive cardiac enzymes without obstructive atherosclerosis on angiography

For structure and function, evaluation of intra- and extra-cardiac structures, LV/RV mass and volumes, MRA, quantification of valvular disease, and delayed contrast enhancement, MRI/MRA is:

- Appropriate for evaluation of cardiac mass (suspected tumor or thrombus) and use of contrast for perfusion and enhancement
- Appropriate for evaluation of pericardial conditions (pericardial mass, constrictive pericarditis)
- Appropriate for evaluation for aortic dissection
- Appropriate for evaluation of pulmonary veins prior to radiofrequency ablation for atrial fibrillation and left atrial and pulmonary venous anatomy including dimensions of veins for mapping purposes

American Heart Association (AHA)

The AHA published a Scientific Statement “Noninvasive Coronary Artery Imaging: Magnetic Resonance Angiography and Multidetector Computed Tomography Angiography” (Bluemke, et al., 2008). The AHA states that the chief advantages of coronary CTA compared with MRA are wider availability, higher spatial resolution, and more consistent, shorter examinations with better patient adherence. Advantages associated with coronary MRA are a lack of ionizing radiation and a lack of administration of iodinated contrast material. Both tests are presently suboptimal for patients with atrial fibrillation and other arrhythmias, and image quality may be further reduced by high body mass. The AHA notes that specific recommendations for use of these technologies are expected to change along with advances in scanner hardware and software. At present, the following general statements represent the consensus opinions of the writing group:

1. Neither coronary CTA nor MRA should be used to screen for coronary artery disease in patients who have no signs or symptoms suggestive of coronary artery disease. (Class* III)

2. No multivendor trial data are available for coronary MDCT CTA or for present whole-heart coronary MRA. Thus, the applicability of these methods beyond the reporting research centers is unknown. Ideally, both multivendor and additional multicenter validation of these methods should be performed. (Class I)

3. The potential benefit of noninvasive coronary angiography is likely to be greatest and is reasonable for symptomatic patients who are at intermediate risk for coronary artery disease after initial risk stratification, including patients with equivocal stress-test results. (Class IIa)

Diagnostic accuracy favors coronary CTA over MRA for these patients. (Class I)

Concerns regarding radiation dose limit the use of coronary CTA in high-risk patients who have a very low pretest likelihood of coronary stenoses; patients with a high pretest likelihood of coronary stenoses are likely to require intervention and invasive catheter angiography for definitive evaluation; thus, CTA is not recommended for those individuals. (Class III)

Pronounced coronary calcification may negatively impact interpretability and accuracy of coronary CTA and thus, the usefulness of CTA is uncertain in these individuals. (Class IIb)

4. Anomalous coronary artery evaluation can be performed by either CTA or MRA; radiation-protection concerns indicate that MRA is preferred when it is available. (Class IIa)

5. Reporting of coronary CTA and MRA results should describe any limitations to the technical quality of the examination and the size of the vessels, descriptions of coronary anomalies, coronary stenosis, and significant noncardiac findings within the field of view. (Class I)

6. Continued research in cardiac CT and MR imaging is encouraged to determine the potential of these noncatheter-based modalities to detect, characterize, and measure atherosclerotic plaque burden, as well as its change over time or as the result of therapy. (Class I)

*Classification of recommendations and levels of evidence are expressed in the ACC/AHA format as follows:

Class I: Conditions for which there is evidence for and/or general agreement that the procedure or treatment is beneficial, useful, and effective.

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful.

European Federation of Neurological Societies (EFNS)

The EFNS Guideline on neuroimaging in acute stroke states the following regarding MRA:

Imaging of the Brain

In conjunction with MRI and MRA, perfusion and diffusion MR are very helpful for the evaluation of patients with acute ischemic stroke (Class I). Perfusion and diffusion MR are helpful to select patients for intravenous thrombolysis beyond 3 hour (Class II). MRI with MRA is the method recommended for the diagnosis and follow-up of arterial dissection (Class II).

Imaging of Extracranial Vessels

MR angiography has slightly higher sensitivity and specificity than US to determine carotid stenosis and occlusion, but other factors, such as availability, may render one procedure more useful than the other (Class II).

Imaging of Intracranial Vessels

MRA and CTA are very useful for the diagnosis of intracranial stenosis and cerebral aneurysms > 5 mm (Class II). MRA is the recommended technique for screening cerebral aneurysms in individuals with a history of aneurysms or SAH in a first-degree relative (class II, level B). MRI with MRA is recommended for the diagnosis and follow-up of cerebral venous thrombosis (CVT) (Class II).

Evidence Classification Scheme for a Diagnostic Measure:

Class I: A prospective study in a broad spectrum of persons with the suspected condition, using a "gold standard" for case definition, where the test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy

Class II: A prospective study of a narrow spectrum of persons with the suspected condition, or a well-designed retrospective study of a broad spectrum of persons with an established condition (by "gold standard") compared to a broad spectrum of controls, where test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy

Class III: Evidence provided by a retrospective study where either persons with the established condition or controls are of a narrow spectrum, and where test is applied in a blinded evaluation

Class IV: Any design where test is not applied in blinded evaluation OR evidence provided by expert opinion alone or in descriptive case series (without controls) (Masdeu, et al., 2006)

American College of Radiology (ACR)

The ACR has two practice guidelines regarding MRA: 1) for the performance of pediatric and adult cerebrovascular (i.e., assessment of vessels of the head and neck) MRA (2005), and 2) for the performance of pediatric and adult body (i.e., assessment of vessels below the thoracic inlet) MRA (2005).

Pediatric and Adult Cerebrovascular MRA (October, 2005): Cerebrovascular MRA is a proven and useful tool for the evaluation, assessment of severity, and follow-up of diseases of the cerebrovascular system. MRA is a rapidly evolving technology. Consequently, only general recommendations can be made regarding imaging techniques. Detailed imaging protocols have been omitted here to avoid promoting obsolete methodology.

MRA has important attributes that make it valuable in the assessment of vascular disease. Compared to radiographic catheter-based angiography, it is noninvasive with no risk of neurologic deficit, circulatory compromise due to vascular injury, or adverse effects of iodinated contrast material. Compared to vascular ultrasound, it is less operator-dependent, has greater freedom from interference by body habitus, and has greater three-dimensional capability. Children demonstrate a different spectrum of disease than do adults, and the routine protocols used for evaluating the adult patient may not be optimal or even appropriate in evaluating children. As the brain and the cerebrovascular system develop during infancy and childhood, cerebrovascular MRA can provide valuable information regarding flow conditions and pathologic processes within the brain and spine. However, technical and safety issues are more complex in pediatric patients. The smaller size of the pediatric patient increases the demand for higher resolution. In addition, sedation is frequently required to successfully complete the examination.

Pediatric Indications for Cerebrovascular MRA

MRA is particularly applicable in children due to the risk (albeit low) related to angiographic procedures. Various studies of children with strokes that compared MRA to conventional angiography found MRA to be: 1) accurate in the delineation of stenosis and/or occlusion, and 2) able to demonstrate collateral vascular anatomy. Indications for cerebrovascular MRA for children include, but are not limited to, the definition and evaluation of the following:

- arterial dissection
- dural sinus thrombosis
- cerebral arteriovenous malformations
- vascular status following extracorporeal membrane oxygenation
- intracranial aneurysm
- vascular abnormalities associated with sickle cell anemia
- blood supply to vascular neoplasms for operative planning
- etiology of intracranial hemorrhage and spinal hemorrhage
- presence, nature, and extent of injury to cervicocerebral vessels, including dissection
- presence of intracranial venous occlusive disease and spinal venous drainage
- nature and extent of other congenital or acquired vascular abnormality

Indications for cerebrovascular MRA of adults include, but are not limited to, the definition and evaluation of the following:

- presence and extent of atherosclerotic occlusive disease and thromboembolic phenomena

- etiology of intracranial hemorrhage and spinal hemorrhage
- relevant vascular anatomy for determining the effect of therapeutic measures including post-treatment evaluation of endovascular treatment of aneurysm and arteriovenous malformation (AVM) ablation
- presence, location, and anatomy of extracranial and intracranial aneurysms and vascular malformations
- presence, nature, and extent of injury to cervicocerebral vessels, including dissection
- vascular supply to tumors
- presence of intracranial venous occlusive disease and spinal venous drainage
- nature and extent of other congenital or acquired vascular abnormality

Evaluation of the aortic arch and subclavian arteries in adults and children may require separate techniques and sequences. Indications include, but are not limited to, the following:

- dissection of the aorta and great vessels to the brain
- aneurysm of the aorta and/or its branches, and subclavian steal
- differentiation of aneurysms and masses
- definition of the relationship of masses to nearby vascular structures
- identification of congenital abnormalities of the aorta, such as coarctation, double arch, and aberrant subclavian artery
- evaluation of superior vena cava syndrome or unilateral upper extremity edema

Pediatric and Adult Body MRA (October, 2005): MRA is a proven and useful tool for the evaluation, assessment of severity, and follow-up of diseases of the vascular system. MRA is a rapidly evolving technology. Consequently, only general recommendations can be made regarding imaging techniques. Detailed imaging protocols have been omitted to avoid promoting obsolete methodology.

MRA has important attributes that make it valuable in the assessment of vascular disease. Compared to radiographic catheter-based invasive angiography, it is noninvasive with no risk of arterial injury or adverse effects from iodinated contrast media. Compared to vascular ultrasound, it is less operator dependent, yields images of the vascular system in a format familiar to referring physicians, is less limited by body habitus, and has greater three-dimensional capability. MRA is also useful in diagnosis of vascular disease in children. Pediatric MRA may require specialized imaging approaches to accommodate the different spectrum of disease as compared to that seen in adults.

General Considerations

Adult indications for body MRA include, but are not limited to, the definition and evaluation of the following:

- presence and extent of atherosclerotic occlusive disease and thromboembolic phenomena
- etiology of visceral, thoracic, abdominal, or pelvic hemorrhage
- relevant vascular anatomy for determining the effect of therapeutic measures, including post-treatment evaluation of endovascular treatment of aneurysm, stenosis, and arteriovenous malformation (AVM) ablation
- presence, location, and anatomy of aneurysms and vascular malformations
- presence, nature, and extent of injury to vessels, including dissection
- vascular supply to tumors
- presence of venous disease
- nature and extent of other congenital or acquired vascular abnormality

Specific Considerations

- thoracic vasculature
 - thoracic aorta
 - coronary artery assessments
 - pulmonary venous evaluations
 - pulmonary arterial evaluations
 - internal mammary and intercostal vessel evaluations
 - bronchial arteries

- extremity evaluations
 - arterial evaluations
 - assessment for vascular involvement with musculoskeletal tumors
 - venous evaluations
- abdominal and pelvic MRA
- pediatric indications for body MRA
 - arterial dissection
 - congenital anomalies of the aorta and associated branch vessels
 - vascular malformations of the trunk and extremity
 - vasculitides
 - aneurysmal disease
 - vascular abnormalities associated with sickle cell anemia
 - blood supply to vascular neoplasms for operative planning
 - vascular anastomoses and complications of organ transplants
 - presence of visceral venous occlusive disease
 - postoperative anatomy following vascular surgery
- Evaluation of the aortic arch and subclavian arteries in adults and children may require separate techniques and sequences. Indications include, but are not limited to, the following:
 - dissection of the aorta and/or its branches
 - aneurysm of the aorta and/or its branches, and subclavian steal
 - differentiation of aneurysms and masses
 - definition of the relationship of masses to nearby vascular structures
 - identification of congenital abnormalities of the aorta, such as coarctation, double arch, and aberrant subclavian artery
 - evaluation of superior vena cava syndrome or unilateral upper extremity edema

The American College of Radiology Appropriateness Criteria[®] for Suspected Spine Trauma (December, 2007) notes that either CTA or MRA can be performed depending on institutional preference if acute cervical spine trauma is suspected.

Summary

Magnetic resonance angiography (MRA) and venography (MRV) provide images of normal and diseased blood vessels as well as visualization and quantification of blood flow through these vessels. The term MRA is frequently used to describe MR imaging of both arteries and veins. The gold standard for many manifestations of vascular disease, especially arterial occlusive disease, is conventional x-ray angiography, which uses iodinated contrast. MRA does not require x-rays, inserting a catheter, or injecting contrast material to make blood vessels visible. A contrast dye may be used to get a clearer image, but it has a much lower risk of reactions as compared to the contrast dye used in catheter angiography and computed tomography angiography (CTA). Therefore, MRA is an effective alternative when there is a specific contraindication for the patient to receive iodinated contrast material (i.e., patient has allergy to iodinated contrast material, renal insufficiency, or has a medical condition that precludes exposure to additional large doses of ionizing radiation). MRA is an effective imaging tool for imaging of vessels of the head, neck, thorax, abdomen and extremities including vascular abnormalities associated with congenital conditions. MRA may be useful in some population subsets for screening and surveillance of intracranial aneurysms.

The utilization of MRA for coronary artery disease screening is not established, nor its role in detecting pulmonary embolism. Evidence in the published, peer-reviewed scientific literature does not support the use of MRA for coronary artery disease screening, pulmonary embolism, or any other indication.

Coding/Billing Information

Note: This list of codes may not be all-inclusive.

Covered when medically necessary:

CPT ^{®*}	Description
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Codes	
70544	Magnetic resonance angiography, head; without contrast material(s)
70545	Magnetic resonance angiography, head; with contrast material(s)
70546	Magnetic resonance angiography, head; without contrast material(s), followed by contrast material(s) and further sequences
70547	Magnetic resonance angiography, neck; without contrast material(s)
70548	Magnetic resonance angiography, neck; with contrast material(s)
70549	Magnetic resonance angiography, neck; without contrast material(s), followed by contrast material(s) and further sequences
71555	Magnetic resonance angiography, chest (excluding myocardium), with or without contrast material(s)
72159	Magnetic resonance angiography, spinal canal and contents, with or without contrast material(s)
72198	Magnetic resonance angiography, pelvis, with or without contrast material(s)
73225	Magnetic resonance angiography, upper extremity, with or without contrast material(s)
73725	Magnetic resonance angiography, lower extremity, with or without contrast material(s)
74185	Magnetic resonance angiography, abdomen, with or without contrast material(s)

HCPCS Codes	Description
C8900	Magnetic resonance angiography with contrast, abdomen
C8901	Magnetic resonance angiography without contrast, abdomen
C8902	Magnetic resonance angiography without contrast followed by with contrast, abdomen
C8909	Magnetic resonance angiography with contrast, chest (excluding myocardium)
C8910	Magnetic resonance angiography without contrast, chest (excluding myocardium)
C8911	Magnetic resonance angiography without contrast followed by with contrast, chest (excluding myocardium)
C8912	Magnetic resonance angiography with contrast, lower extremity
C8913	Magnetic resonance angiography without contrast, lower extremity
C8914	Magnetic resonance angiography without contrast followed by with contrast, lower extremity
C8918	Magnetic resonance angiography with contrast, pelvis
C8919	Magnetic resonance angiography without contrast, pelvis
C8920	Magnetic resonance angiography without contrast followed by with contrast, pelvis

ICD-9-CM Diagnosis Codes	Description
	Multiple/varied

Experimental/Investigational/Unproven/Not Covered:

ICD-9-CM Diagnosis Codes	Description
415.1-415.19	Pulmonary embolism
V45.81	Postprocedural aortocoronary bypass status
V81.0	Screening for ischemic heart disease
V81.2	Screening for other and unspecified cardiovascular conditions
	All other codes

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2. American College of Radiology Practice Guideline for the performance of Pediatric and Adult Body MRA. Effective October 2005. Accessed July 2008. Available at URL address: http://www.acr.org/SecondaryMainMenuCategories/quality_safety/guidelines/dx/cardio/body_mra.aspx
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Policy History

<u>Pre-Merger Organizations</u>	<u>Last Review Date</u>	<u>Policy Number</u>	<u>Title</u>
CIGNA HealthCare	9/15/2008	0154	Magnetic Resonance Angiography (MRA)

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Connecticut General Life Insurance Company has acquired the business of Great-West Healthcare from Great-West Life & Annuity Insurance Company (GWLA). Certain products continue to be provided by GWLA (Life, Accident and Disability, and Excess Loss). GWLA is not licensed to do business in New York. In New York, these products are sold by GWLA’s subsidiary, First Great-West Life & Annuity Insurance Company, White Plains, N.Y.